Examination of the Mauna Loa Robertson-Berger Meter Data for Calibration Inconsistencies

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This investigation was concerned with the stability of the calibrations done by Temple University on the Robertson-Berger (R-B) meter [*Berger*, 1976] instrumentation at MLO.

A demonstration of the R-B meter stability and a demonstration of a drift in the calibration can be seen in the data obtained at MLO that is operated by CMDL. Clear skies were determined by continuous direct-sun radiometer measurements made routinely at the observatory. A Dobson instrument operated at the station supplied the total ozone data [*Komhyr et al.*, 1989]. Figure 1 is the calculated ratio of the calibrated MLO R-B meter data to the model calculated irradiance (scaled to a convenient magnitude) and Figure 2 is the ratio using the uncalibrated R-B meter data. The large variations seen in the clustered groups of points reflect calibration and instrumental problems requiring several replacements in the early part of the record, therefore, rendering the data unfit for the *Scotto et al.* [1988] analysis. Attention is called to the record after 1979; the period when the calibrated data ratio showed a downward trend of roughly 10% between 1979 and 1988. It is our understanding that *Scotto et al.* [1988] used a linear interpolation method to remove the discontinuities between calibration periods and this is why calibration jumps do not appear in the calibrated data previous to 1988. Apparently, this was not done in 1987 when an upward jump appeared. The uncalibrated data ratio showed virtually no trend, remaining

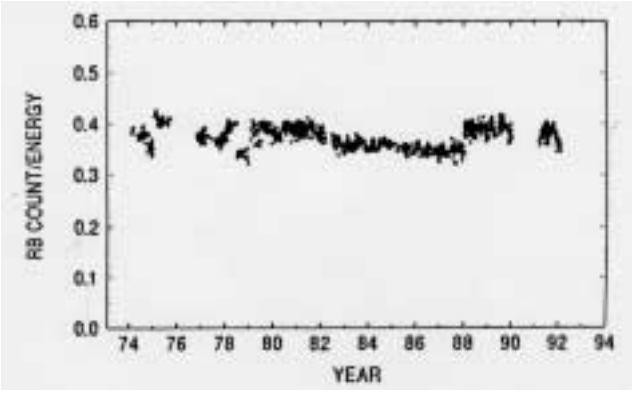

Fig. 1. Ratio of calibrated MLO R-B meter data to model calculated iradiance. The R-B meter data is the half-hour value sum 11:00-11:30 a.m. for clear days between 1974 and 1992.

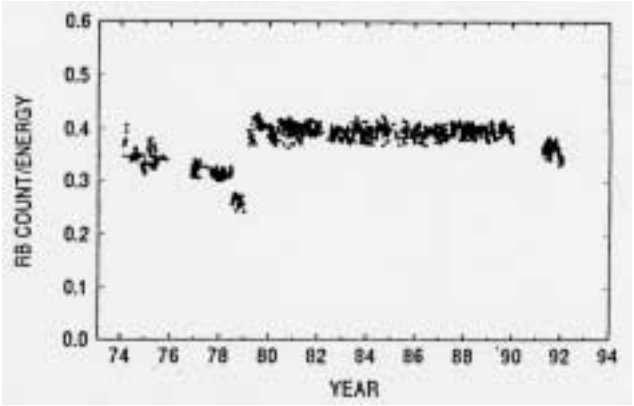

Fig. 2. Ratio of uncalibrated Mauna Loa R-B meter data to model calculated irradiance as in Figure 1.

remarkably uniform, and thereby demonstrating the stability of a meter and the soundness of our approach. During this period, the instrument operated without an incident that would require replacement. Considering the exceptional quality of the MLO site for viewing the sky radiation, there is no reasonable explanation for the downward trend seen in the calibrated ratio data other than a calibration error.

The eruption of El Chichon occurred in the spring of 1982 and a short data gap exists near this time in the R-B meter record. Nevertheless, the ratio hardly varies after 1981 indicating little sensitivity to the stratospheric aerosol that was still significant after the data gap. The aerosol optical depth ranged between 0.1 and 0.2 or roughly 10 times greater than background [see *DeLuisi et al.*, 1989]. A maximum stratospheric aerosol optical depth of slightly more than 0.1 from El Chichon occurred over the U.S. in January 1983 [e.g., *DeLuisi et al.*, 1989]. Strong forward scattering and minimal absorption of UV radiation by the stratospheric aerosols are believed to be responsible for the UV irradiance. On the basis of this result, it seems unlikely that a significant effect would be seen over the U.S. The experience with the Mauna Loa data led us to proceed with a similar analysis of the data used by *Scotto et al.* [1988] in search of a pattern that might be attributed to possible calibration inconsistencies. A paper is being prepared summarizing the results of examining the calibrations of instruments operating in the U.S. network.

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